

Efficient and Accurate Computational Framework for Injector Design and Analysis, Phase II

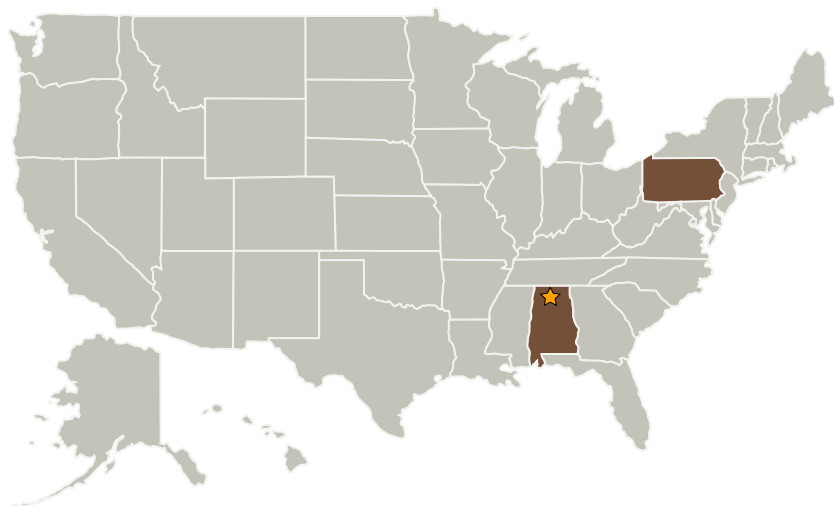
Completed Technology Project (2006 - 2008)



Project Introduction

The proposed effort addresses a current need for high fidelity simulation tools to support the design and analysis of combustion devices for the Constellation program and Exploration Mission that includes earth-to-orbit, upper stage, as well as in-space propulsion systems. Injector designs are a critical component of robust thrust chamber assembly designs since they impact combustion chamber instability and its transient response. Inadequate injector designs have been the cause of major failures during engine development of all earlier liquid rocket systems including the SSME; the root cause for this may be attributed to the use of relatively simple empirically based, one-dimensional tools in the design process that are incapable of identifying localized failures driven by three-dimensional geometry and physics effects. The proposed three-dimensional, CFD tool will focus on rigorous modeling of the mixing and combustion processes in cryogenic liquid-gas injectors that operate in the trans-critical and sub-critical regime and exhibit strong non-linear sensitivities to real fluid thermodynamics, as well as turbulent mixing effects. The advanced models developed will permit improved predictions of combustion chamber mean heat flux and localized peaks, as well as lay the foundation for predicting unsteady response of the injector and its coupling to the feed system dynamics.

Primary U.S. Work Locations and Key Partners



Efficient and Accurate
Computational Framework for
Injector Design and Analysis,
Phase II

Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Areas	2

Efficient and Accurate Computational Framework for Injector Design and Analysis, Phase II

Completed Technology Project (2006 - 2008)



Organizations Performing Work	Role	Type	Location
★ Marshall Space Flight Center (MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
CRAFT Tech - Combustion Research and Flow Technology	Supporting Organization	Industry	Pipersville, Pennsylvania

Primary U.S. Work Locations	
Alabama	Pennsylvania

Project Transitions

**December 2006:** Project Start**November 2008:** Closed out

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.1 Cryogenic Systems
 - └ TX14.1.5 Cryogenic Analysis, Safety & Properties